Check List the journal of biodiversity data
NOTES ON GEOGRAPHIC DISTRIBUTION

New records of the minute moss beetle *Ochthebius* (*Enicocerus*) *colveranus* Ferro, 1979 in Slovakia (Coleoptera, Hydraenidae)

Ján Kodada[1], Marcel Harman[2], Dávid Selnekovič[1]

1 *Department of Zoology, Faculty of Natural Sciences, Comenius University in Bratislava, Ilkovičova 6, 842 15 Bratislava, Slovakia*
2 *Kladzany 6, SK-09421 Kladzany, Slovakia*

Corresponding author: *Ján Kodada (jan.kodada@uniba.sk)*

Abstract. We present new records of the minute moss beetle *Ochthebius* (*Enicocerus*) *colveranus* Ferro, 1979, rediscovered after more than 90 years in Slovakia. Adults inhabit the growth of algae (*Vaucheria* sp. and *Cladophora* sp.) and moss on the spray zone of protruding rocks in streams. We recently discovered small populations in rivers Laborec, Ondava, Udava, Výrava and the stream Hermanovský Potok in north-eastern Slovakia. *Ochthebius melanescens* Dalla Torre, 1877 and *O. metallescens* Rosenbauer, 1847 shared the same microhabitat. We provide illustrations of the habitus, aedeagus, habitat, and a distribution map of northernmost localities.

Key words. Central Europe, distributional range, faunistics, identification, water beetles

Kodada J, Harman M, Selnekovič D (2024) New records of the minute moss beetle *Ochthebius* (*Enicocerus*) *colveranus* Ferro, 1979 in Slovakia (Coleoptera, Hydraenidae) Check List 20 (6): 1216–1221. https://doi.org/10.15560/20.5.1216

INTRODUCTION

The genus *Ochthebius* Leach, 1815 is a speciose genus of minute moss beetles (Hydraenidae) comprising several hundred species distributed globally with representatives in both hemispheres (Bilton et al. 2022). The genus contains 10 subgenera (Villastrigo et al. 2019), and *Ochthebius colveranus* Ferro, 1979 belongs with another 22 species to the subgenus *Enicocerus* Stephens, 1929 (Jäch 2004; Skale and Jäch 2009; Ribera et al. 2010). Most species are small, with a body size of around 2 mm; however, the largest European species, *O. granulatus* Mulsant, 1844, has a body size of up to 3.5 mm.

Ochthebius colveranus is widespread in Europe (Jäch 2004), and it occurs from north-eastern Italy, south-eastern Central Europe, and south-eastern Europe to Turkey and the Caucasus Region (Jäch 2004; Delgado and Jäch 2014). Beier and Pomeisl (1959) studied the population of *O. colveranus* living in the stream Mauerbach in Vienna Wood (a branch of the foothills of the Alps). They discovered a fascinating life cycle and described and illustrated the larva, pupa, and morphological characters of adults. Larvae and adults cannot swim and live on shore rocks and rocks projecting from the water close above the waterline. On these rocks, they found a permanently wet zone about 4 cm wide with the algae *Cladophora* sp. and *Vaucheria* sp., where adults and older larvae with already-developed spiracles occurred, while younger larvae without spiracles lived submersed. The pupation occurs in a wet zone covered by fine mud above the algae zone. Mature larvae and adults occurred together, mainly in August and September. Have all the pupae hatched until the end of September or early October. Both larvae and adults feed on unicellular algae and detritus, and the oral apparatus of adults shows an apparent modification for scraping algae (Beier and Pomeisl 1959).

Kodada et al. (2003) published a comprehensive checklist of water beetles from Slovakia, and the inclusion of *O. colveranus* was based only on a sample from 1930 taken in north-western Slovakia from the Rajčianka River.

During the sampling process for the prepared new Red Book of invertebrates of Slovakia, we visited numerous localities, and here we present new distributional records for *O. colveranus* from anthropologically less-impacted rivers in north-eastern Slovakia.

OPEN ACCESS

Academic editor: Bruno Clarkson
Received: 22 July 2024
Accepted: 21 October 2024
Published: 24 October 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

METHODS

Generally, we used a D-frame hand net to collect water beetles and applied a multihabitat scheme to sample significant habitats proportionally according to their presence within a sampling reach. We also sampled microhabitats covering less than 5% of the studied area, such as submerged mosses on stones, exposed submerged fine rootlets of shore vegetation, and, especially for *Ochthebius* specimens, growth of algae and moss in the spray zone of partly submerged rock and boulders as well as hygropetric sites. We sampled by positioning the net and disturbing the substrate for a distance that equals the square of the frame width upstream of the net. When taking samples from moss and algae, we positioned the net immediately downstream of them while the vegetation was gently combed by hand, enabling the specimens to float into the net. After three or four replicates, we rinsed the collected material two or three times with stream water, sorted specimens directly in the field, and immediately preserved them in 96% ethanol. We also visually inspected the stones protruding from the water and sampled *Ochthebius* adults by tweezers. Additionally, we used stamping and shore-washing of stream banks to sample riparian species, then collected the floating debris and beetles using a net.

In the laboratory, we extracted male genitalia from relaxed specimens, cleared them in lactic acid for two days, and temporarily mounted them on a microscope slide with a single cavity in Berlese fluid. After examination, we mounted the male genitals in a drop of DMHF on the same card as the respective specimen.

We examined specimens using a Leica M205C stereomicroscope with fusion optics and diffuse lighting at magnifications up to 160×. We used a Zeiss Axio Zoom.V16 stereomicroscope, diffuse LED lighting, a Canon 5D Mark IV camera, and ZereneStacker 1.04 (Zerene Systems 2024) for the habitus photograph. Photographs of genitalia were taken with a Zeiss Axio Imager.M2 microscope.

For identifying the taxa of *Ochthebius* we used the publications of Jäch (1992, 1998), Delgado and Jäch (2014), and Ribera et al. (2010).

Voucher specimens are in the collection of Ján Kodada (CKB) in the Department of Zoology, Faculty of Natural Sciences, Comenius University in Bratislava, Slovakia, and the Marcel Harman collection (MHC) in Kladzany, Slovakia.

We created the distribution map using QGIS 3.30 (QGIS.org 2024) software and edited it using Adobe Illustrator CC 2024 (Adobe Inc. 2024). It includes published data from Csabai and Szél (1999), Straka et al. (2012), and Twardy (2015).

RESULTS

***Ochthebius* (*Enicocerus*) *colveranus* Ferro, 1979**

Ochthebius (*Enicocerus*) *ineditus* Ferro, 1982. Synonymized by Jäch (1992).
Ochthebius (*Enicocerus*) *phtius* Ferro, 1988. Synonymized by Jäch (1992).
Figures 1, 2

Material examined for the new records. SLOVAKIA – Prešovský kraj (Prešov region) • Svetlice village environment, Výrava River; ca. 49°09′58.722″N, 022°1′17.343″E; 11.IX.2021; alt. 310 m; J. Kodada & D. Selnekovič leg.; 3 ♂, 2 ♀, CKB OC1–3 • Svetlice village environment, Výrava River; ca. 49°09′58.720″N, 022°01′17.226″E; 2.X.2023; alt. 310 m; J. Kodada & D. Selnekovič leg.; 1 ♂, CKB OC–4 • Svetlice village environment, Výrava River; ca. 49°09′58.720″N, 022°01′17.226″E; 30.VI.2024; alt. 310 m; J. Kodada leg.; 1 ♂, CKB OC–5 • Adidovce village environment, Udava River; ca. 49°01′34.0″N, 022°02′40.8″E; 11.IX.2021; alt. 200 m; J. Kodada & D. Selnekovič leg.; 2 ♂, 1 ♀, CKB OC6–7 • Adidovce village environment, Udava River; ca. 49°01′31.559″N, 022°02′36.639″E; 2.X.2023; alt. 200 m; J. Kodada & D. Selnekovič leg.; 3 ♂, 4 ♀, CKB OC8–15 • Adidovce village environment, Udava River; ca. 49°01′33.074″N, 022°02′39.469″E; alt. 200 m; 29.IX.2023; M. Harman leg.; 1 ex., MHC OCMH1 • same data except 24.X.2023; M. Harman leg.; 2 ex., MHC OCMH2–3 • same data except 18.V.2024; M. Harman leg.; 6 ex., MHC OCMH4–9 • Adidovce village environment, Udava River; ca. 49°01′32.749″N, 022°02′38.725″E; 29.VI.2024; alt. 200 m; J. Kodada leg.; 13 ♂, 24 ♀, CKB OCJ1–37 • Kladzany village environment, Ondava River; ca. 48°53′14.672″N, 021°44′31.290″E; 5.X.2023; alt. 110 m; M. Harman leg.; 1 ex., MHC OCMH10 • Volica village environment, Laborec River; 49°09′18.119″N, 021°54′48.056″E; 12.VII.2024; alt. 210 m; M. Harman leg.; 1 ex., MHC OMH11 • Hermanovce nad Topľou village environment, Hermanovský Potok stream; 48°57′57.2″N, 021°29′05.4″E; alt. 440 m; 12.IX.2021; J. Kodada & D. Selnekovič leg.; 2 ♂, CKB OCJ38–39.

Material examined of the first Slovakian record. SLOVAKIA – Žilinský kraj (Žilina region) • Lietavská Lúčka village environment, Rajčianka River; 25.VII.1930; L. Korbel leg.; 3 ♂, 6 ♀, CKB OCLK1-9.

Identification. According to Ribera et al. (2010), *O. colveranus* belongs to the *O. exsculptus* species group, including *O. aguilerai* Ribera, Castro & Hernandes, 2010, *O. legionensis* Hebauer & Vallades, 1985, *O. halbherri* Reiter, 1890, and *O. exsculptus* Germar, 1824. Their arrangement was based on four mitochondrial and two nuclear genes and identified *O. gibbosus* Germar, 1824 and *O. melanescens* Dalla Torre, 1877 as sister

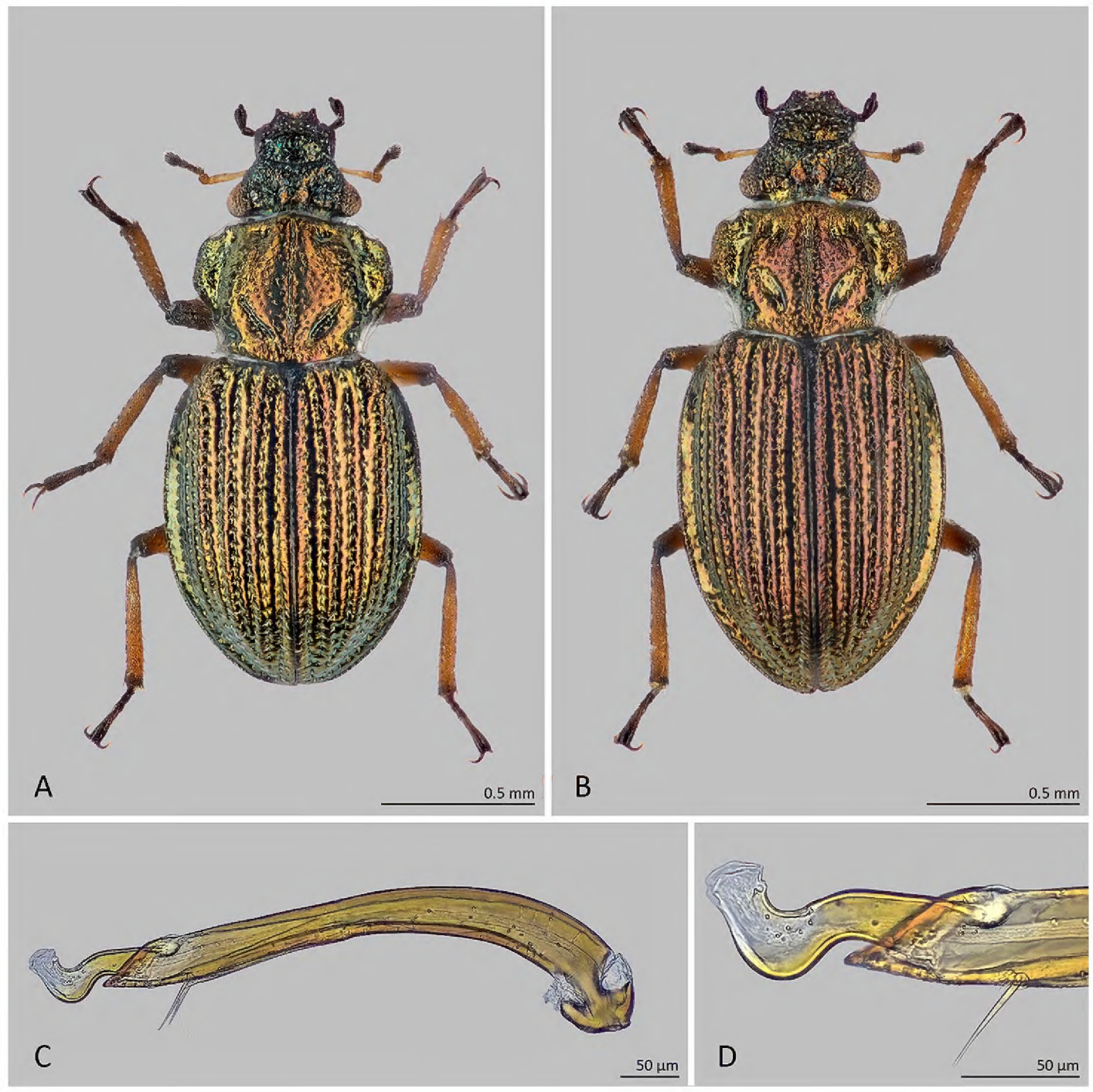

Figure 1. *Ochthebius colveranus*. **A.** Habitus of male, dorsal view. **B.** Habitus of female, dorsal view. **C.** Aedeagus, lateral view. **D.** Distal portion of aedeagus, lateral view.

taxa. *Ochthebius aguilerai* and *O. legionensis* have been reported only from Spain, while other species have a wider distributional range. Except for *O. gibbosus*, each species is similar in external morphology and varies in size and color. For identification, it is necessary to examine the aedeagus (Jäch 1998).

Habitus, as in Figure 1A, B. Body length is 1.5–2.2 mm. Color with strong coppery-greenish metallic luster or dark, nearly black with a greenish-blue metallic luster. Body appendages are yellowish brown; the apical half of the antennae, palpi, knees, and tarsi are dark brown. The upper surface is sparsely covered with short whitish adpressed pubescence and is shining and glabrous. The ventral surface, except for the ventrite VI and pygidial sclerite, is densely covered with short, silvery pubescence. The anterior margin of the labrum is emarginated; anterior lobes are transverse, and the exterior angle frequently produces anteriad, acute. Labrum and clypeus are sparsely punctuated; the surface has an indistinct microreticulation. Frons is more densely punctate, with a shagreened appearance. The pronotum is sexually dimorphic. In males, it is usually strongly convex, with posterior admedian foveae more elongated, while the anterior foveae are smaller than posterior ones, and the surface has less impressed and relatively sparser punctation. The pronotum of the female is moderately convex and roughly trapezoidal. All admedian foveae and sulcus are well impressed, median sulcus reaching almost anterior and posterior margins; pronotal punctures are strongly impressed, sparse; space between punctures is finely chagrined; lateral margin is widely explanate and densely punctured. Elytra are oval and strongly convex, with ten strongly impressed regular striae; intervals are more or less strongly convex, especially intervals 3, 5, and 7. The sutural interval is raised; however, at the end of the anterior third, the elytron is lower and, in lateral view, shows a delicate depression. Aedeagus (Figure 2C, D) is long and slender. The main piece is moderately bent in the basal half (lateral view) and has a narrow and tapered apex; parameres are short, adjoining the median lobe. The distal lobe is moderately large, with distinct ventral flexion; however, the variability of the shape of the distal lobe is sometimes remarkably pronounced also within populations (Delgado and Jäch 2014: figs. 1, 2).

The externally most similar *O. exsculptus* differs in the slenderer distal lobe of the aedeagus, which shows only weak ventral flexion near the apex (Jäch 1998: fig. 23a; Ribera et al. 2010: figs. 7–10).

Ochthebius melanescens differs in nearly flat or indistinctly convex pronotum of males, broader and less convex elytra with more regularly convex intervals, and in distinctly larger distal lobe of aedeagus (Jäch 1998: fig. 23b).

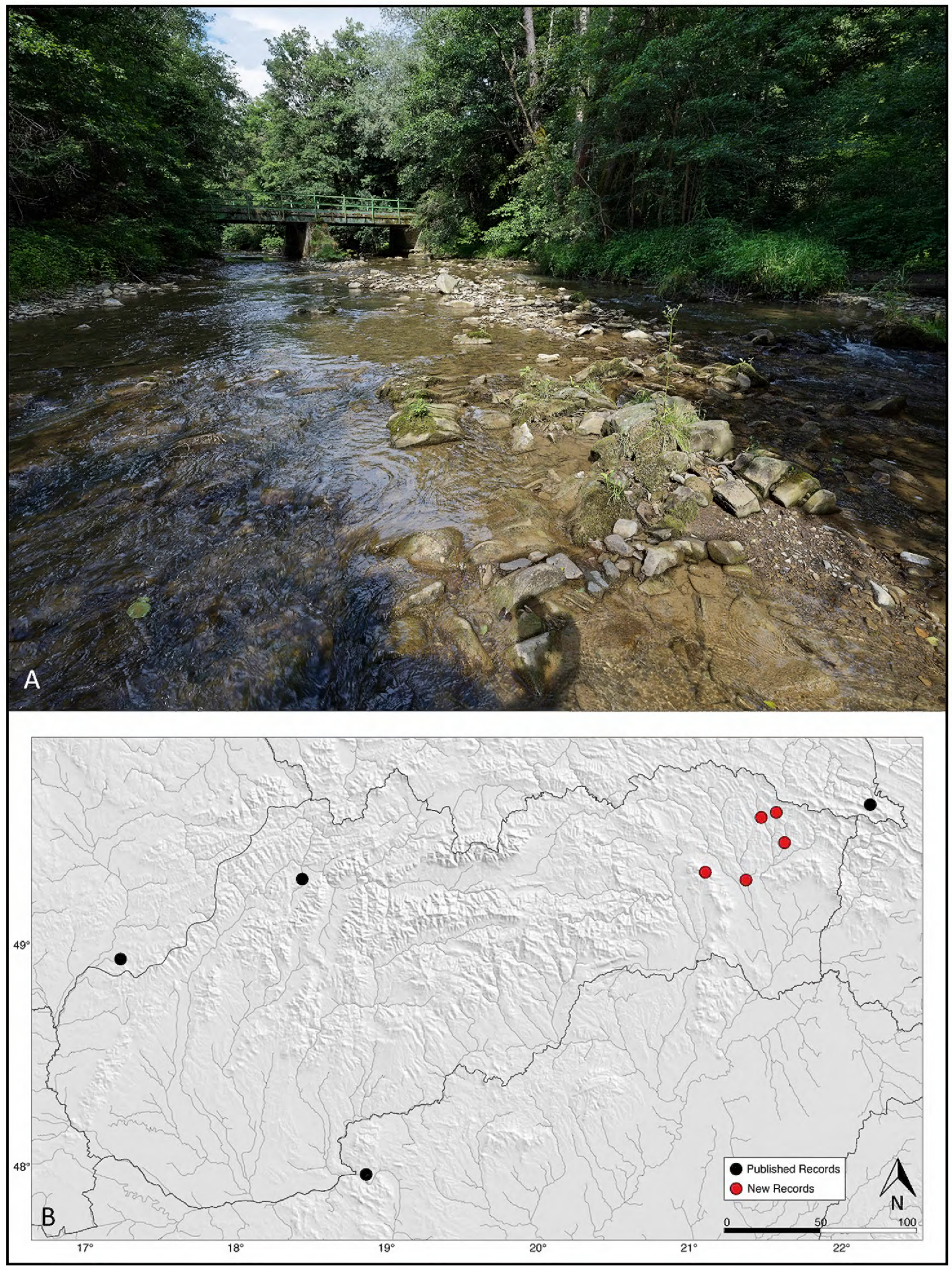

Figure 2. A. The Udava River upstream of Adidovce. **B.** The northernmost distribution of *O. colveranus*.

Co-occurring species. *Ochthebius melanescens* and *O. metallescens* co-occurred in all the localities in north-eastern Slovakia in the same habitats. Both these species were more abundant than *O. colveranus*.

Distribution. Albania, Armenia, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Georgia, Germany, Greece, Hungary, Italy, Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, Ukraine, and Turkey (Jäch 2004; Straka et al. 2012; Twardy 2015).

DISCUSSION

For a long time, the only Slovak record for *O. colveranus* was a sample of 10 individuals from the vicinity of the village of Lietavská Lúčka, located in the southern part of the Žilina uplands near the Rajčianka River. Prof. Ladislav Korbel collected these individuals from the splash zone of rocks in 1930. Their distribution was clumped, and he observed numerous specimens dwelling on rocks pointing out of the water (L. Korbel 2000 personal communication). The species identification was made around 2000, during the preparation of a list of aquatic macroinvertebrates of Slovakia (Kodada et al. 2003). The identification of *O. colveranus* was a surprise, and we immediately visited the site. However, a large cement plant was built in Lietavská Lúčka during the times of socialism, and other regional developments occurred, so natural conditions deteriorated significantly. We have also lately tried to verify the species' presence in the Rajčianka River

and its tributaries. However, only recently (2022–23) have we detected the populations of *O. melanescens* and *O. metallescens* near the village of Čičmany in Rajčianka River and above the village of Rajecká Lesná in the Lesnianka stream. Unfortunately, we did not confirm the presence of *O. colveranus*. Current climate change has adversely impacted the area. In 2022, the Rajčianka River even dried up in a 1.5 km section in the cadaster of Rajecká Lesná village, and the flow of all tributaries recently fluctuates a lot, which has a destructive impact on the development of larvae.

Interestingly, the first record from Czechia comes from ca. 150 km south-western lying Velička stream in Hroznova Lhota (Bíle Karpaty Protected Landscape Area) and is based on a single male specimen collected in 2010 (Straka et al. 2012); similarly, Straka et al. did not discover other specimens during later sampling (M. Straka 2024 personal communication).

Examination of water beetles in the Nízke Beskydy Region (north-eastern Slovakia) during spring and autumn 2003 from 12 sampling sites reveals *O. foveolatus*, *O. melanescens*, and *O. metallescens*. However, no *O. colveranus* specimen was recorded (Zaťovičová et al. 2024). We can rule out the incorrect collecting methods or identification errors in this case, so later discovering *O. colveranus* males in the Výrava River near the village of Svetlice in 2021 was a surprise. Sampling in the Hermanovský Potok stream, Udava, Ondava, and Laborec rivers revealed additional specimens; however, the population density is low. It is questionable whether the species is spreading further north in the context of climate change or if small populations existed here before.

Contrary to the Slovak portion of Nízke Beskydy, Twardy (2015) discovered in the stream Wołosaty, situated only about 100 km north-east of Adidovce in south-eastern Poland (Bieszczady Mountains), numerous specimens of *O. colveranus*. It was the first record from Poland. So far, the records from Slovakia and Poland represent the northernmost distributional limits of the species.

Recently, easily accessible DNA sequencing provided exciting possibilities, so Ribera et al. (2010) analyzed six fragments of the mitochondrial and nuclear genome and, in *O. exsculptus*, discovered the existence of two clades within Spain. *Ochthebius colveranus* is a widely distributed and variable species with two synonyms, so testing the existence of different genetic lineages will be challenging.

ACKNOWLEDGEMENTS

Thanks to Manfred A. Jäch (NMW), who first identified specimens collected by L. Korbel in 1930. Alica Christophoryová helped prepare the habitus photograph and arranged all the illustrations. Ján Kodada thanks Prof. RNDr. Ladislav Korbel (June 8, 1912, Čachtice – † February 6, 2006, Bratislava; a Slovak entomologist–coleopterologist, university professor) for specimens of *O. colveranus* from Lietavská Lúčka. We also want to thank the reviewers for their comments, which have improved the quality of the manuscript.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

The Slovak Research and Development Agency (project APVV-19-0076) and VEGA (project 1/0541/23) financially supported this study.

Author contributions

Conceptualization: JK. Funding acquisition: JK. Project administration: DS. Visualization: DS. Writing – original draft: JK, DS. Writing – review and editing: JK, DS, MH.

Author ORCID iDs

Jan Kodada https://orcid.org/0000-0002-1355-4323
Marcel Harman https://orcid.org/0009-0000-1715-5023
Dávid Selnekovič https://orcid.org/0000-0002-9228-1174

Data availability

All data supporting this study's findings are available in the main text.

REFERENCES

Adobe Inc. (2024) Adobe Illustrator. Adobe Inc., San José, Kalifornia, USA. https://www.adobe.com/products/illustrator.html?promoid=FHRLZ9BG&mv=other. Accessed on: 2024-08-14.

Beier M, Pomeisl E (1959) Einiges über Körperbau und Lebensweise von *Ochthebius exsculptus* Germ. und seiner Larve (Col. Hydroph. Hydraen.). Zeitschrift für Morphologie und Ökologie der Tiere 48: 72–88.

Bilton D, Jäch MA, Ribera I, Toussaint EFA (2022) Minute moss beetles in the Southern Hemisphere: Molecular phylogeny, historical biogeography and habitat shifts (Coleoptera: Hydraenidae). Systematic Entomology 48: 142–162. https://doi.org/10.1111/syen.12567

Csabai Z, Szél G (1999) Checklist of Spercheidae, Hydrochidae, Helophoridae, Hydrophilidae and Hydraenidae of Hungary (Coleoptera). Folia Entomologica Hungarica 60: 213–230.

Delgado JA, Jäch MA (2014) Revision of the Palaearctic species of the genus *Ochthebius* Leach XXVIII. *Ochthebius* (*Enicocerus*) *colveranus* FERRO, 1979: inter- and intrapopulational aedeagal variability (Coleoptera: Hydraenidae). Koleopterologische Rundschau 84: 75–79.

Jäch MA (1992) Revision of the Palearctic species of the genus *Ochthebius* Leach. VII. The subgenus *Enicocerus* Stephens (Coleoptera: Hydraenidae). Elytron 5: 139–158.

Jäch MA (1998) Familie: Hydraenidae. In: Lohse GA, Klausnitzer B (Eds.) Die Käfer Mitteleuropas, Band 15 (4. Supplementband). Goecke & Evers, Krefeld, Germany, 83–97.

Jäch MA (2004) Family Hydraenidae Mulsant, 1844. In: Löbl I, Smetana A (Eds.) Catalogue of Palaearctic Coleoptera, 2. Hydrophiloidea – Histeroidea – Staphylinoidea. Apollo Books, Stenstrup, Denmark, 102–122.

Kodada J, Jäch MA, Cséfalvay R (2003) Výskyt bezstavovcov (makroevertebrát) v jednotlivých povodiach Slovenska: Coleoptera. In: Šporka F (Ed.) Vodné bezstavovce (makroevertebráta) Slovenska. Súpis druhov a autekologické charakteristiky. Slovenský hydrometeorologický ústav Bratislava, Slovakia, 138–159.

QGIS.org (2024) QGIS Geographic Information System. QGIS Association, Grüt, Switzerland. http://www.qgis.org. Accessed on: 2024-08-14.

Ribera I, Castro A, Hernando C (2010) *Ochthebius* (*Enicocerus*) *aguilerai* sp. n. from central Spain, with a molecular phylogeny of the Western Palaearctic species of *Enicocerus* (Coleoptera, Hydraenidae). Zootaxa 2351: 1–13. https://doi.org/10.11646/zootaxa.2351.1

Skale A, Jäch MA (2009) Revision of the Palearctic species of the genus *Ochthebius* Leach (Insecta: Coleoptera: Hydraenidae) XXVI. A new species of *Enicocerus* Stephens from Iran. Annalen des Naturhistorischen Museums in Wien, B 110: 51–56.

Straka M, Komzák P, Boukal D, Trávníček D (2012) Minute moss beetles and riffle beetles (Coleoptera: Hydraenidae, Elmidae) of the Bílé Karpaty Protected Landscape Area and Biosphere Reserve (Czech Republic). Acta Musei Moraviae, Scientiae Biologicae (Brno) 96 (2) 2011: 667–689.

Twardy D (2015) Pierwsze stwierdzenie *Ochthebius* (*Enicocerus*) *colveranus* Ferro, 1979 w Polsce oraz dane o występowaniu innych rzadkich gatunków z rodzaju *Ochthebius* Leach, 1815 (Coleoptera: Staphylinoidea: Hydraenidae). Wiadomości Entomologiczne 34 (2): 5–11.

Villastrigo A, Jäch MA, Cardoso A, Valladares LF, Ribera A (2019) A molecular phylogeny of the tribe Ochthebiini (Coleoptera, Hydraenidae, Ochthebiinae). Systematic Entomology 44: 273–288. https://doi.org/10.1111/syen.12318

Zaťovičová Z, Čiampor F, Kodada J (2004) Aquatic Coleoptera (Insecta) of streams in the Nízke Beskydy Region (Slovakia): faunistics, ecology and comparison of sampling methods. Biologia, Bratislava, 59 (Supplement 15): 181–189.

Zerene Systems (2024) Zerene Stacker. Zerene Systems LLC, Richmond, Washington, USA. https://zerenesystems.com/cms/stacker. Accessed on: 2024-08-14.